Thermal imaging of Erta 'Ale active lava lake (Ethiopia)

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Active lava lakes represent the uppermost portion of a volume of convective magma exposed to the atmosphere, and provide open windows on magma dynamics within shallow reservoirs. Erta 'Ale volcano located within the Danakil Depression in Ethiopia, hosts one of the few permanent convecting lava lakes, active at least since the last century.

We report here the main features of Erta 'Ale lake surface investigated using a handheld infrared thermal camera between 11 and 12 November 2006. In both days, the lake surface was mainly characterized by efficient magma circulation reflecting in the formation of well-marked incandescent cracks and wide crust plates. These crossed the lake from the upwelling to the downwelling margin with mean speeds ranging between 0.01 and 0.15 m s^{-1}. Hot spots opened eventually in the middle of crust plates and/or along cracks. These produced explosive activity lasting commonly between ~10 and 200 s. Apparent temperatures at cracks ranged between ~700 and 1070˚C, and between ~300 and 500˚C at crust plates. Radiative power output of the lake varied between ~45 and 76 MW according to the superficial activity and continuous resurfacing of the lake. Time series analysis of the radiant power output data reveals cyclicity with a period of ~10 min. The combination of visual and thermal observations with apparent mean temperatures and convection rates allows us to interpret these signals as the periodic release of hot overpressured gas bubbles at the lake surface.

Keywords: *Erta 'Ale, lava lake, thermal imaging, lava lake features, radiant power output*